



Removal of Copper ions from Aqueous Solutions Using Chitosan Coated with Iron Oxide Nanoparticle

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ABSTRACT

Water samples were collected from three different locations in Basra Governorate, southern Iraq: the first from Ras Al-Bisha Al-Faw; the second from the Basra Shatt site near the main outlet of the Hamdan wastewater treatment plant, and the third from the Khor Al-Zubair site near the mangrove nursery. The prepared composite was tested as a surface that adsorbs Cu^{2+} ions from watery liquids. FT-IR, XRD, FE-SEM EDX, and zeta potential were among the methods used to characterize the produced nanocomposite. The results showed that the copper removal efficiency of the prepared surface reached 93.33% in the first location, 70.99% in the second location, and 74.02% in the third location. This study addressed the preparation of chitosan coated with nano-iron oxide. The experimental adsorption data were subjected to the Langmuir and Freundlich model mathematical equations, which took temperature study results into consideration. The particle size calculated from the Debye-Scherr equation was about 23.28nm, which was extracted from the patterns of X-ray diffraction. The purity of the phase was demonstrated, and the Langmuir equation showed a higher linear correlation than the Freundlich equation. The positive values of ΔH calculated from the thermodynamic curves demonstrated that the adhesion of copper ions was endothermic, while the negative values of ΔG confirmed the spontaneity of the adsorption process, and the positive values of ΔS indicated an increase in randomness at the solid-solution interface during adsorption.

INTRODUCTION

Over the past century, the world has witnessed rapid increase in urbanization and industrialization, resulting in the release of large quantities of heavy metal ions into the environment through various human actions, including electroplating, chemical manufacturing, mining, fertilizer use, and pesticide use (Wai *et al.*, 2017; Hama Aziz *et al.*, 2023). This has transformed soil and water pollution with heavy metals into a serious global environmental and health problem (Aldoghachi & Altamimi, 2021; Kanwal *et al.*, 2024). These metals are characterized by their high toxicity when exceeding